

A METHOD OF WATER PURIFICATION BY INDUCED FROTH (FOAM) FORMATION

The present invention relates to the water treatment, wastewater treatment, clean-up of polluted sites of streams directly on site, clean-up of contaminated sites and any other reasons from pollutants or contaminants.

In the patent, U.S. Pat. No. 4,244,819, dated Jun., 1981, a floating anti-pollution barrier for combating water pollution is disclosed. The floating pockets of the barrier, the openings of which are downwardly disposed, are given their shape and kept in shape by masses of a material which is lighter than water.

10 In the patent, U.S. Pat. No. 5,122,165, dated Jun., 1992, a process system and apparatus for removal of toxic volatile compounds and surfactants from a contaminated liquid stream is described. This process system involves liquid pumping; gas purification by a foam collector; etc.

Flotational separation techniques, especially the techniques such as those in U.S. Pat. No. 5,306,422 dated Apr., 1994 and U.S. Pat. No. 5,538,631 dated Jul., 1996 allow to treat the waste water.

In the patent U.S. Pat. No. 5,840,156 dated Nov., 1998, a froth flotational process for deinking wastewater using multiflow pressurized deinking module is disclosed.

20 To the best knowledge of Your Petitioner the proposed induced froth (form) formation process and natural purification method is based on discovered natural phenomenon – natural froth formation process by which the river purifies itself in extraordinary circumstances (after a toxic spill), not only entire water but also the affected benthic soil, to the environmentally acceptable levels for these particular habitats. Nature showed us the manner in which a river purifies itself. With the knowledge of the natural purification of creeks and rivers through froth formation, our next step was to understand the

mechanisms involved in this process. In brief, our hypothesis is the following:

In the decomposing process of total organics, including organic pollution, the river, including the entire water and the benthic soil, are enriched with natural biological surfactants such as humic acids, amino acids, fatty acids and others; and the generating dissolved biogases and micro-bubbles of biogases such as oxygen, ammonia, carbon dioxide, nitrogen, methane, hydrogen sulfide and others. This system also contains
30 dissolved air, air bubbles created from the air captured from atmosphere and all kinds of polluting particles, including man-made surfactants.

For generating air and/or biogases micro-bubbles and attaching of the polluting particles to the air and biogases micro-bubbles in the presence of the biological and man-made surfactants and further for rising the bubbles-particles aggregates as well as the decomposed matter from the benthic soil to water surface, the proper external and/or internal conditions must exist. Water cascading over the weirs, waterfalls and other obstacles, creating the shallow-turbulent character of the stream current is the one of examples of the suitable condition for bubble-particle attachments. The particles-bubbles aggregates as well as the decomposed matter which are enriched with micro-bubbles of
40 biogases will rise to the water surface of the river downstream from the weirs, waterfalls and other obstacles, creating the shallow-turbulent character of water current and concentrate in the froth and the surrounding thin top layer of surface water. The resulting froth and the surrounding thin top layer of surface water comprise a high concentration of polluting agents from both the entire water and the benthic soil. This process affects all the pollutants, organic and inorganic, including pathogens.

The formed froth and the surrounding thin top layer of surface water are concentrated and localized in the proper designed places by any devices for further skimming off for disposal and/or redirecting to artificially created places for natural treatment directly on
50 site and/or delivering to municipal or natural treatment facilities.

As a result, we can, without any chemical addition, by utilizing the natural purification processes only, intervene directly on site in water treatment, wastewater treatment, clean-

up of contaminated sites or clean-up of the streams that is heavily polluted from both the point and the non-point polluting sources or any other reasons.

In fact, what do you immediately notice when you visit Niagara Falls? Of course, you are first struck by the majesty of the view. You are impressed by the power and volume of water. Look more closely. You will also see a great deal of froth on the water surface. The
60 froth gathers along the banks in large amount.

Did you consider the question, why does the froth accumulate? One normally does not give much thought to this point. In fact, this is the manner in which the river purifies itself from all kinds of pollutants, including pathogens.

In drawings which illustrate an example of the embodiments of the invention, Figure 1 is a top view that presents a schematic view of the process for removing the froth and thin top layer of surface water from polluted sites of stream directly on sites, where:

- 1 is a weir in stream;
- 2 is a shallow-turbulent area of water current in stream;
- 3 is a direction of surface water flow;
- 4 is surface water;
- 5 is a direction of froth and thin top layer of surface water flow;
- 6 is a device or equipment for stopping, concentrating, localizing and/or redirecting of froth and thin top layer of surface water in the proper places for removal;
- 7 is a skimmer with pipe for pumping the froth and thin top layer of surface water from the proper places to a tank;
- 8 is the tank;
- 9 is a bank of stream.

In drawings which illustrate an example of the embodiments of the invention, Figure 2 is a top view that presents a schematic view of the process for natural biological treatment of froth and thin top layer of surface water directly on polluted sites of stream, where:

- 1 is a weir in stream;
- 2 is a shallow-turbulent area of water current in stream;
- 3 is a direction of surface water flow;
- 4 is surface water;
- 5 is a direction of froth and thin top layer of surface water flow;
- 6 is a device or equipment for stopping, concentrating, localizing and/or redirecting of froth and thin top layer of surface water in the proper places for biological treatment;
- 7 is a bank of stream;
- 8 are rushes or any other plants using for artificially created biological treatment in the proper places where the froth and thin top layer are concentrated and localized.

In drawings which illustrate an example of the embodiments of the invention, Figure 3 is a top view that presents a schematic view of the equipment or device using for stopping the tree logs or other heavy debris in stream for further removal them, where:

- 1 is a direction of surface water flow;
- 2 is a bank of stream;
- 3 is surface water;
- 4 is a metallic stick;
- 5 is a tree log;
- 6 is a metallic rope.